Plasmonic-Molecular Electronic Integration and Bioelectronic Interfaces

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The recent development of plasmonics and the ability to confine light into subwavelength metallic waveguides enables the exciting possibility of combining photonics and electronics at the nanoscale. Hybrid molecular-plasmonic devices wherein plasmons regulate electron flow or vice versa can be envisioned for future generation devices. This talk will explore the first steps towards this integration, employing plasmons to analyze several different molecular electronic architectures, as well as using molecules to regulate plasmonic transport. We will examine coupling into metal-insulator-metal (MIM) plasmon modes, which can increase the local field strength up to 10^3, greatly enhancing nonlinear optical processes.

The ability to confine electrical signals to nanometer scales can also have important applications to biology. We will explore one example of an electronic-biological 'translation' chip that can provide precise spatial and temporal chemical signaling. This system is comprised of microfabricated reservoirs within a silicon chip, each of which can hold a specific biological signaling molecule, and release it upon command.